CLAIMS

1. An information recording apparatus comprising:

a mounting means on which a removable disk-shaped optical recording medium is set in place;

a rotation driving means for rotating the disk-shaped optical recording medium set on the mounting means at a predetermined velocity;

a pulse signal generating means for generating N (N is a natural number) pulse signals in a predetermined cycle while the disk-shaped optical recording medium is being rotated one full turn by the rotation driving means;

a counting means for counting the N pulse signals generated by the pulse generating means;

a storage means for storing an axial-runout amount detected in a predetermined radial position on the disk-shaped optical recording medium in timing of generation of the pulse signals by the pulse signal generating means in correspondence with the count value in the counting means;

a light source to emit a light beam of a predetermined wavelength modulated with information to be written to the information recording surface of the disk-shaped optical recording medium;

a near-field light projecting means for condensing a light beam emitted from the light source and projecting the condensed light beam as near-field light to the

information recording surface when it is located in a field near the information recording surface of the disk-shaped optical recording medium;

a radial-position information detecting means for detecting radial-position information indicative of a radial position on the information recording surface of the disk-shaped optical recording medium being irradiated with the light beam from the near-field light projecting means;

a gain generating means for generating a predetermined gain corresponding to radial-position information detected by the radial-position information detecting means;

an axial-runout amount reading means for reading an axial-runout amount stored in the storage means correspondingly to the count of pulse signals counted by the counting means;

a first controlling means for generating a control signal by multiplying the axial-runout amount read by the axial-runout amount reading means by the predetermined gain generated by the gain generating means to control the near-field light projecting means to follow the axial-runout amount;

a return-light amount detecting means for detecting a return-light amount of the near-field light projected to the information recording surface; and

a second controlling means for controlling the near-field light projecting means on the basis of the linear characteristic of the return light amount of the near-field light detected by the return-light amount detecting means to keep a predetermined

distance within the near field from the information recording surface.

2. The apparatus according to claim 1, further comprising a third controlling means for controlling, when the return-light amount detected by the return-light amount detecting means is larger than a predetermined threshold, the near-field light projecting means to be located in the field near the information recording surface of the disk-shaped optical recording medium.

3. The apparatus according to claim 1, further comprising:

an optical means for condensing the light beam emitted from the light source and projecting the condensed light beam to the information recording surface of the disk-shaped optical recording medium; and

an axial-runout amount detecting means for detecting an axial-runout amount of the disk-shaped optical recording medium from the return part of the light beam projected from the optical means,

the storage means storing an axial-runout amount in a predetermined radial position on the disk-shaped optical recording medium, detected by the axial-runout amount detecting means in timing of generation of the pulse signal by the pulse signal generating means, in correspondence with the count value in the counting means.

4. The apparatus according to claim 1, wherein:

the storage means stores the axial-runout amount at a radius Rm of the disk-shaped optical recording medium; and

the gain generating means generates a gain at a radius Rn detected by the

radial-position information detecting means, as $\beta \times (Rn/Rm)$, from an amplitude β of the largest one of the axial-runout amount at a radius Rm stored in the storage means.

5. The apparatus according to claim 1, wherein the near-field light projecting means includes an SIL (solid immersion lens).

6. The apparatus according to claim 1, where the near-field light projecting means includes an SIM (solid immersion mirror).

7. An information recording controlling method comprising:

a mounting step in which a removable disk-shaped optical recording medium is set in place;

a rotation driving step in which the set disk-shaped optical recording medium is rotated at a predetermined velocity;

a pulse signal generating step in which N (N is a natural number) pulse signals are generated in a predetermined cycle while the disk-shaped optical recording medium is being rotated one full turn in the rotation driving step;

a counting step in which there are counted the N pulse signals generated in the pulse generating step;

a storing step in which an axial-runout amount detected in a predetermined radial position on the disk-shaped optical recording medium in timing of generation of the pulse signals in the pulse signal generating step is stored in correspondence with the count value counted in the counting step;

a near-field light projecting step in which there is condensed a light beam of a

predetermined wavelength modulated with information to be written to the information recording surface of the disk-shaped optical recording medium and emitted from a light source and the condensed light beam is projected as near-field light to the information recording surface from a near-field light projecting means located in a field near the information recording surface of the disk-shaped optical recording medium;

a radial-position information detecting step in which there is detected radial-position information indicative of a radial position on the information recording surface of the disk-shaped optical recording medium being irradiated with the light beam from the near-field light projecting means;

a gain generating step in which there is generated a predetermined gain corresponding to radial-position information detected in the radial-position information detecting step;

an axial-runout amount reading step in which an axial-runout amount stored in the storing step is read correspondingly to the count of pulse signals counted in the counting step;

a first controlling step in which a control signal is generated by multiplying the axial-runout amount read in the axial-runout amount reading step by the predetermined gain generated in the gain generating step to control the near-field light projecting means to follow the axial-runout amount;

a return-light amount detecting step in which there is detected a return-light

amount of the near-field light projected to the information recording surface; and

a second controlling step in which the near-field light projecting means is controlled based on the linear characteristic of the return light amount of the near-field light detected in the return-light amount detecting step to keep a predetermined distance within the near field from the information recording surface.

8. An information recording apparatus comprising:

a mounting means on which a removable disk-shaped optical recording medium is set in place;

a rotation driving means for rotating the disk-shaped optical recording medium set on the mounting means at a predetermined velocity;

a pulse signal generating means for generating (N is a natural number) pulse signals in a predetermined cycle while the disk-shaped optical recording medium is being rotated one full turn by the rotation driving means;

a counting means for counting the N pulse signals generated by the pulse generating means;

a storage means for storing an axial-runout amount detected in timing of generation of the pulse signals by the pulse signal generating means in correspondence with the count value in the counting means and radial-position information;

a light source to emit a light beam of a predetermined wavelength modulated with information to be written to the information recording surface of the disk-shaped

optical recording medium;

a near-field light projecting means for condensing a light beam emitted from the light source and projecting the condensed light beam as near-field light to the information recording surface when it is located in a field near the information recording surface of the disk-shaped optical recording medium;

a radial-position information detecting means for detecting radial-position information indicative of a radial position on the information recording surface of the disk-shaped optical recording medium being irradiated with the light beam from the near-field light projecting means;

an axial-runout amount reading means for reading an axial-runout amount stored in the storage means correspondingly to the count of pulse signals counted by the counting means and radial-position information detected by the radial-position information detecting means;

a first controlling means for controlling the near-field light projecting means on the basis of the axial-runout amount read by the axial-runout amount reading means to follow the axial-runout amount;

a return-light amount detecting means for detecting a return-light amount of the near-field light projected to the information recording surface; and

a second controlling means for controlling the near-field light projecting means on the basis of the linear characteristic of the return light amount of the near-field light detected by the return-light amount detecting means to keep a predetermined

distance within the near field from the information recording surface.

9. An information recording controlling method comprising:

a mounting set in which a removable disk-shaped optical recording medium is set in place;

a rotation driving step in which the set disk-shaped optical recording medium is rotated at a predetermined velocity;

a pulse signal generating step in which (N is a natural number) pulse signals are generated in a predetermined cycle while the disk-shaped optical recording medium is being rotated one full turn in the rotation driving step;

a counting step in which there are counted the N pulse signals generated in the pulse generating step;

a storing step in which an axial-runout amount detected in timing of generation of the pulse signals in the pulse signal generating step is stored in correspondence with the count value counted in the counting step and radial-position information;

a near-field light projecting in which there is condensed a light beam of a predetermined wavelength modulated with information to be written to the information recording surface of the disk-shaped optical recording medium and emitted from a light source and the condensed light beam is projected as near-field light to the information recording surface from a near-field light projecting means located in a field near the information recording surface of the disk-shaped optical recording medium;

a radial-position information detecting step in which there is detected radial-position information indicative of a radial position on the information recording surface of the disk-shaped optical recording medium being irradiated with the light beam from the near-field light projecting means;

an axial-runout amount reading step in which there is read an axial-runout amount stored in the storing step correspondingly to the count of pulse signals counted in the counting step and radial-position information detected in the radial-position information detecting step;

a first controlling step in which the near-field light projecting means is controlled based on the axial-runout amount read in the axial-runout amount reading step to follow the axial-runout amount;

a return-light amount detecting step in which there is detected a return-light amount of the near-field light projected to the information recording surface; and

a second controlling step in which the near-field light projecting means is controlled based on the linear characteristic of the return light amount of the near-field light detected in the return-light amount detecting step to keep a predetermined distance within the near field from the information recording surface.

10. An information recording apparatus comprising:

a mounting means on which a removable disk-shaped optical recording medium is set in place;

a light source to emit a light beam of a predetermined wavelength modulated

with information to be written to the information recording surface of the disk-shaped optical recording medium;

an optical means for condensing the light beam emitted from the light source and projecting it to the information recording surface of the disk-shaped optical recording medium;

an axial-runout detecting means for detecting an axial-runout amount of the disk-shaped optical recording medium from the return light of the light beam projected by the optical means;

a near-field light projecting means for condensing a light beam emitted from the light source and projecting the condensed light beam as near-field light to the information recording surface when it is located in a field near the information recording surface of the disk-shaped optical recording medium;

a return-light amount detecting means for detecting a return-light amount of the near-field light projected to the information recording surface;

a first controlling means for controlling, when the axial-runout amount detected by the axial-runout amount detecting means is larger than a first threshold, the near-field light projecting means to follow the axial-runout amount; and

a second controlling means for controlling, when the axial-runout amount detected by the axial-runout amount detecting means is smaller than the first threshold, the near-field light projecting means on the basis of the linear characteristic of the return light amount of the near-field light detected by the return-light amount

detecting means to keep a predetermined distance within the near field from the information recording surface.

11. An information recording controlling method comprising:

a mounting step in which a removable disk-shaped optical recording medium is set in place;

an axial-runout detecting step in which there is condensed a light beam of a predetermined wavelength modulated with information to be written to the information recording surface of the disk-shaped optical recording medium and emitted from a light source to detect an axial-runout amount of the disk-shaped optical recording medium from the return light of the light beam projected to the information recording surface of the disk-shaped optical recording medium;

a near-field light projecting step in which the light beam emitted from the light source is condensed and the condensed light beam is projected as near-field light to the information recording surface from a near-field light projecting means located in a field near the information recording surface of the disk-shaped optical recording medium;

a return-light amount detecting step in which there is detected a return-light amount of the near-field light projected to the information recording surface;

a first controlling step in which, when the axial-runout amount detected in the axial-runout amount detecting step is larger than a first threshold, the near-field light projecting means is controlled to follow the axial-runout amount; and

a second controlling step in which, when the axial-runout amount detected in the axial-runout amount detecting step is smaller than the first threshold, the near-field light projecting means is controlled based on the linear characteristic of the return light amount of the near-field light detected in the return-light amount detecting step to keep a predetermined distance within the near field from the information recording surface.

12. An information reproducing apparatus comprising:

a mounting means on which a removable disk-shaped optical recording medium is set in place;

a rotation driving means for rotating the disk-shaped optical recording medium set on the mounting means at a predetermined velocity;

a pulse signal generating means for generating N (N is a natural number) pulse signals in a predetermined cycle while the disk-shaped optical recording medium is being rotated one full turn by the rotation driving means;

a counting means for counting the N pulse signals generated by the pulse generating means;

a storage means for storing an axial-runout amount detected in a predetermined radial position on the disk-shaped optical recording medium in timing of generation of the pulse signals by the pulse signal generating means in correspondence with the count value in the counting means and radial-position information;

a light source to emit a light beam of a predetermined wavelength to read

predetermined information recorded on the information recording surface of the disk-shaped optical recording medium;

a near-field light projecting means for condensing a light beam emitted from the light source and projecting the condensed light beam as near-field light to the information recording surface when it is located in a field near the information recording surface of the disk-shaped optical recording medium;

a radial-position information detecting means for detecting radial-position information indicative of a radial position on the information recording surface of the disk-shaped optical recording medium being irradiated with the light beam from the near-field light projecting means;

a gain generating means for generating a predetermined gain corresponding to the count of the pulse signals counted by the counting means;

an axial-runout amount reading means for reading an axial-runout amount stored in the storage means correspondingly to the count of pulse signals counted by the counting means and radial-position information detected by the radial-position information detecting means;

a first controlling means for controlling the near-field light projecting means on the basis of the axial-runout amount read by the axial-runout amount reading means to follow the axial-runout amount;

a return-light amount detecting means for detecting a return-light amount of the near-field light projected to the information recording surface; and

a second controlling means for controlling the near-field light projecting means on the basis of the linear characteristic of the return light amount of the near-field light detected by the return-light amount detecting means to keep a predetermined distance within the near field from the information recording surface.

13. The apparatus according to claim 12, further comprising a signal extracting means for extracting a read signal and gap error signal by splitting the return-light amount detected by the return-light amount detecting means with a predetermined frequency,

the second controlling means controlling the near-field light projecting means on the basis of the linear characteristic of the gap error signal extracted by the signal extracting means to keep a predetermined distance within the near field from the information recording surface.

14. The apparatus according to claim 12, further comprising:

a polarization splitting means for splitting the return light of the near-field light projected to the information recording surface into a first return light and second return light on the basis of a difference in polarization plane,

the return-light amount detecting means detecting the amount of the second return light split by the polarization splitting means; and

the second controlling means controlling the near-field light projecting means on the basis of the linear characteristic of the amount of the second return light detected by the return-light amount detecting means to keep a predetermined distance within

the near field from the information recording surface.

15. An information reproduction controlling method comprising:

a mounting step in which a removable disk-shaped optical recording medium is set in place;

a rotation driving step in which the set disk-shaped optical recording medium is rotated at a predetermined velocity;

a pulse signal generating step in which N (N is a natural number) pulse signals are generated in a predetermined cycle while the disk-shaped optical recording medium is being rotated one full turn in the rotation driving step;

a counting step in which there are counted the N pulse signals generated in the pulse generating step;

a storing step in which an axial-runout amount detected in a predetermined radial position on the disk-shaped optical recording medium in timing of generation of the pulse signals in the pulse signal generating step is stored in correspondence with the count value in the counting step and radial-position information;

a near-field light projecting step in which there is condensed a light beam of a predetermined wavelength emitted from a light source to read predetermined information recorded on the information recording surface of the disk-shaped optical recording medium and the condensed light beam is projected as near-field light to the information recording surface from a near-field light projecting means located in a field near the information recording surface of the disk-shaped optical recording

medium;

a radial-position information detecting step in which there is detected radial-position information indicative of a radial position on the information recording surface of the disk-shaped optical recording medium being irradiated with the light beam from the near-field light projecting means;

a gain generating step in which there is generated a predetermined gain corresponding to the count of the pulse signals counted in the counting step;

an axial-runout amount reading step in which an axial-runout amount stored in the storing step is read correspondingly to the count of pulse signals counted in the counting step;

a first controlling step in which the near-field light projecting means is controlled based on the axial-runout amount read in the axial-runout amount reading step to follow the axial-runout amount;

a return-light amount detecting step in which there is detected a return-light amount of the near-field light projected to the information recording surface; and

a second controlling step in which the near-field light projecting means is controlled based on the linear characteristic of the return light amount of the near-field light detected in the return-light amount detecting step to keep a predetermined distance within the near field from the information recording surface.

16. An information reproducing apparatus comprising:

a mounting means on which a removable disk-shaped optical recording medium

is set in place;

a rotation driving means for rotating the disk-shaped optical recording medium set on the mounting means at a predetermined velocity;

a pulse signal generating means for generating N (N is a natural number) pulse signals in a predetermined cycle while the disk-shaped optical recording medium is being rotated one full turn by the rotation driving means;

a counting means for counting the N pulse signals generated by the pulse generating means;

a storage means for storing an axial-runout amount in a predetermined radial position on the disk-shaped optical recording medium, detected in timing of generation of the pulse signals by the pulse signal generating means, in correspondence with the count value in the counting means;

a light source to emit a light beam of a predetermined wavelength to read predetermined information recorded in the disk-shaped optical recording medium;

a near-field light projecting means for condensing a light beam emitted from the light source and projecting the condensed light beam as near-field light to the information recording surface when it is located in a field near the information recording surface of the disk-shaped optical recording medium;

a radial-position information detecting means for detecting radial-position information indicative of a radial position on the information recording surface of the disk-shaped optical recording medium being irradiated with the light beam from the

near-field light projecting means;

an axial-runout amount reading means for reading an axial-runout amount stored in the storage means correspondingly to the count of pulse signals counted by the counting means and radial-position information detected by the radial-position information detecting means;

a first controlling means for controlling the near-field light projecting means on the basis of the axial-runout amount read by the axial-runout reading means to follow the axial-runout amount;

a return-light amount detecting means for detecting a return-light amount of the near-field light projected to the information recording surface; and

a second controlling means for controlling the near-field light projecting means on the basis of the linear characteristic of the return light amount of the near-field light detected by the return-light amount detecting means to keep a predetermined distance within the near field from the information recording surface.

17. An information reproduction controlling method comprising:

a mounting step in which a removable disk-shaped optical recording medium is set in place;

a rotation driving step in which the set disk-shaped optical recording medium is rotated at a predetermined velocity;

a pulse signal generating step in which N (N is a natural number) pulse signals are generated in a predetermined cycle while the disk-shaped optical recording

medium is being rotated one full turn in the rotation driving step;

a counting step in which there are counted the N pulse signals generated in the pulse generating step;

a storing step in which an axial-runout amount in a predetermined radial position on the disk-shaped optical recording medium, detected in timing of generation of the pulse signals in the pulse signal generating step, is stored in correspondence with the count value counted in the counting step;

a light source to emit;

a near-field light projecting step in which there is condensed a light beam of a predetermined wavelength emitted from a light source to read predetermined information recorded in the disk-shaped optical recording medium and the condensed light beam is projected as near-field light to the information recording surface from a near-field light projecting means located in a field near the information recording surface of the disk-shaped optical recording medium;

a radial-position information detecting step in which there is detected radial-position information indicative of a radial position on the information recording surface of the disk-shaped optical recording medium being irradiated with the light beam from the near-field light projecting means;

an axial-runout amount reading step in which an axial-runout amount stored in the storing step is read correspondingly to the count of pulse signals counted in the counting step and radial-position information detected in the radial-position

information detecting step;

a first controlling step in which the near-field light projecting means is controlled based on the axial-runout amount read in the axial-runout reading step to follow the axial-runout amount;

a return-light amount detecting step in which there is detected a return-light amount of the near-field light projected to the information recording surface; and

a second controlling step in which the near-field light projecting means is controlled based on the linear characteristic of the return light amount of the near-field light detected in the return-light amount detecting step to keep a predetermined distance within the near field from the information recording surface.

18. An information reproducing apparatus comprising:

a mounting means on which a removable disk-shaped optical recording medium is set in place;

a light source to emit a light beam of a predetermined wavelength to read predetermined information recorded on the information recording surface of the disk-shaped optical recording medium;

an optical means for condensing the light beam emitted from the light source and projecting it to the information recording surface of the disk-shaped optical recording medium;

an axial-runout detecting means for detecting an axial-runout amount of the disk-shaped optical recording medium from the return light of the light beam

projected by the optical means;

a near-field light projecting means for condensing a light beam emitted from the light source and projecting the condensed light beam as near-field light to the information recording surface when it is located in a field near the information recording surface of the disk-shaped optical recording medium;

a return-light amount detecting means for detecting a return-light amount of the near-field light projected to the information recording surface;

a first controlling means for controlling, when the axial-runout amount detected by the axial-runout amount detecting means is larger than a first threshold, a driving means on the basis of the axial-runout amount; and

a second controlling means for controlling, when the axial-runout amount detected by the axial-runout amount detecting means is smaller than the first threshold, the near-field light projecting means on the basis of the linear characteristic of the return light amount of the near-field light detected by the return-light amount detecting means to keep a predetermined distance within the near field from the information recording surface.

19. An information reproduction controlling method comprising:

a mounting step in which a removable disk-shaped optical recording medium is set in place;

an axial-runout detecting step in which a light beam of a predetermined wavelength emitted from a light source to read predetermined information recorded

on the information recording surface of the disk-shaped optical recording medium is condensed to detect an axial-runout amount of the disk-shaped optical recording medium from the return light of the light beam projected to the information recording surface of the disk-shaped optical recording medium;

a near-field light projecting step in which the light beam emitted from the light source is condensed and the condensed light beam is projected as near-field light to the information recording surface from a near-field light projecting means located in a field near the information recording surface of the disk-shaped optical recording medium;

a return-light amount detecting step in which there is detected a return-light amount of the near-field light projected to the information recording surface;

a first controlling step in which, when the axial-runout amount detected in the axial-runout amount detecting step is larger than a first threshold, the near-field light projecting means is controlled to follow the axial-runout amount; and

a second controlling step in which, when the axial-runout amount detected in the axial-runout amount detecting step is smaller than the first threshold, the near-field light projecting means is controlled based on the linear characteristic of the return light amount of the near-field light detected in the return-light amount detecting step to keep a predetermined distance within the near field from the information recording surface.

20. An information recording apparatus comprising:

a mounting means on which a removable disk-shaped optical recording medium is set in place;

a rotation driving means for rotating the disk-shaped optical recording medium set on the mounting means;

a pulse signal generating means for generating N (N is a natural number) pulse signals in a predetermined cycle while the disk-shaped optical recording medium is being rotated one full turn by the rotation driving means;

a frequency-to-voltage transducing means for transducing the frequency of a pulse signal generated by the pulse signal generating means into a voltage value;

a voltage value comparing means for making a comparison between the voltage value supplied from the voltage-to-frequency transducing means and a predetermined reference voltage value;

a first velocity controlling means for controlling the velocity of rotation of the rotation driving means on the basis of the result of comparison supplied from the voltage value comparing means;

a phase comparing means for making a comparison between the phase of the pulse signal generated by the pulse signal generating means and the phase of a predetermined reference signal;

a second velocity controlling means for controlling the velocity of rotation of the rotation driving means on the basis of the result of comparison supplied from the phase comparing means;

a light source to emit a light beam of a predetermined wavelength modulated with information to be written to the information recording surface of the disk-shaped optical recording medium;

a near-field light projecting means for condensing a light beam emitted from the light source and projecting the condensed light beam as near-field light to the information recording surface when it is located in a field near the information recording surface of the disk-shaped optical recording medium;

a return-light amount detecting means for detecting the return-light amount of the near-field light projected to the information recording surface;

a first gap controlling means for controlling the near-field light projecting means on the basis of the linear characteristic of the return-light amount of the near-field light detected by the return-light amount detecting means to keep a predetermined distance within the near field from the information recording surface; and

a controlling means for having the first velocity controlling means control the rotation driving means to rotate the disk-shaped optical recording medium at a predetermined velocity, having the second velocity controlling means control the rotation driving means to start driving the rotation of the disk-shaped optical recording medium when the predetermined velocity is reached, and having the first gap controlling means to start controlling the near-field light projecting means when the result of phase comparison supplied from the phase comparing means is smaller than the predetermined threshold.

21. An information recording controlling method comprising:

a mounting step in which a removable disk-shaped optical recording medium is set in place;

a rotation driving step in which the set disk-shaped optical recording medium is rotated by a rotation driving means;

a pulse signal generating step in which N (N is a natural number) pulse signals are generated in a predetermined cycle while the disk-shaped optical recording medium is being rotated one full turn by the rotation driving means;

a frequency-to-voltage transducing step in which the frequency of a pulse signal generated in the pulse signal generating step is transduced into a voltage value;

a voltage value comparing step in which a comparison is made between the voltage value from the voltage-to-frequency transducing step and a predetermined reference voltage value;

a first velocity controlling step in which the velocity of rotation of the rotation driving means is controlled based on the result of comparison from the voltage value comparing step;

a phase comparing step in which a comparison is made between the phase of the pulse signal generated in the pulse signal generating step and the phase of a predetermined reference signal;

a second velocity controlling step in which the velocity of rotation of the rotation driving means is controlled based on the result of comparison in the phase comparing

step;

a near-field light projecting in which there is condensed a light beam of a predetermined wavelength modulated with information to be written to the information recording surface of the disk-shaped optical recording medium and emitted from a light source and the condensed light beam is projected as near-field light to the information recording surface from a near-field light projecting means located in a field near the information recording surface of the disk-shaped optical recording medium;

a return-light amount detecting step in which there is detected the return-light amount of the near-field light projected to the information recording surface;

a first gap controlling step in which the near-field light projecting means is controlled based on the linear characteristic of the return-light amount of the near-field light detected in the return-light amount detecting step to keep a predetermined distance within the near field from the information recording surface; and

a controlling step in which the rotation driving means is controlled in the fist velocity controlling step to rotate the disk-shaped optical recording medium at a predetermined velocity, the second velocity controlling step is started when the predetermined velocity is reached, and the first gap controlling step is started when the result of phase comparison in the phase comparing step is smaller than the predetermined threshold.

22. An information reproducing apparatus comprising:

a mounting means on which a removable disk-shaped optical recording medium is set in place;

a rotation driving means for rotating the disk-shaped optical recording medium set on the mounting means;

a pulse signal generating means for generating N (N is a natural number) pulse signals in a predetermined cycle while the disk-shaped optical recording medium is being rotated one full turn by the rotation driving means;

a frequency-to-voltage transducing means for transducing the frequency of a pulse signal generated by the pulse signal generating means into a voltage value;

a voltage value comparing means for making a comparison between the voltage value supplied from the voltage-to-frequency transducing means and a predetermined reference voltage value;

a first velocity controlling means for controlling the velocity of rotation of the rotation driving means on the basis of the result of comparison in the voltage value comparing means;

a phase comparing means for making a comparison between the phase of the pulse signal generated by the pulse signal generating means and the phase of a predetermined reference signal;

a second velocity controlling means for controlling the velocity of rotation of the rotation driving means on the basis of the result of comparison in the phase comparing

means;

a light source to emit a light beam of a predetermined wavelength to read predetermined information from the information recording surface of the disk-shaped optical recording medium;

a near-field light projecting means for condensing a light beam emitted from the light source and projecting the condensed light beam as near-field light to the information recording surface when it is located in a field near the information recording surface of the disk-shaped optical recording medium;

a return-light amount detecting means for detecting the return-light amount of the near-field light projected to the information recording surface;

a first gap controlling means for controlling, base on the linear characteristic of the return-light amount of the near-field light detected by the return-light amount detecting means, the near-field light projecting means to keep a predetermined distance within the near field from the information recording surface; and

a controlling means for having the first velocity controlling means control the rotation driving means to rotate the disk-shaped optical recording medium at a predetermined velocity, having the second velocity controlling means control the rotation driving means to start driving the rotation of the disk-shaped optical recording medium when the predetermined velocity is reached, and having the first gap controlling means to start controlling the near-field light projecting means when the result of phase comparison supplied from the phase comparing means is smaller than

the predetermined threshold.

23. An information reproduction controlling method comprising:

a mounting step in which a removable disk-shaped optical recording medium is set in place;

a rotation driving step in which the set removable disk-shaped optical recording medium is rotated by a rotation driving means;

a pulse signal generating step in which N (N is a natural number) pulse signals are generated in a predetermined cycle while the disk-shaped optical recording medium is being rotated one full turn by the rotation driving means;

a frequency-to-voltage transducing step in which the frequency of a pulse signal generated in the pulse signal generating step is transduced into a voltage value;

a voltage value comparing step in which a comparison is made between the voltage value supplied from the voltage-to-frequency transducing step and a predetermined reference voltage value;

a first velocity controlling step in which the velocity of rotation of the rotation driving means is controlled based on the result of comparison in the voltage value comparing step;

a phase comparing step in which a comparison is made between the phase of the pulse signal generated in the pulse signal generating step and the phase of a predetermined reference signal;

a second velocity controlling step in which the velocity of rotation of the rotation

driving means is controlled based on the result of comparison in the phase comparing step;

a near-field light projecting in which there is condensed a light beam of a predetermined wavelength to read predetermined information from the information recording surface of the disk-shaped optical recording medium and emitted from a light source and the condensed light beam is projected as near-field light to the information recording surface from a near-field light projecting means located in a field near the information recording surface of the disk-shaped optical recording medium;

a return-light amount detecting in which there is detected the return-light amount of the near-field light projected to the information recording surface;

a first gap controlling step in which the near-field light projecting means is controlled based on the linear characteristic of the return-light amount of the near-field light detected in the return-light amount detecting step to keep a predetermined distance within the near field from the information recording surface; and

a controlling step in which the rotation driving means is controlled to rotate the disk-shaped optical recording medium at a predetermined velocity in the first velocity controlling step, the second velocity controlling step is started when the predetermined velocity is reached, and the first gap controlling step is started when the result of phase comparison supplied from the phase comparing step is smaller than

the predetermined threshold.

24. An information recording apparatus comprising:

a first light source to emit a light beam of a first wavelength, modulated with information to be written to the information recording surface of an optical recording medium;

a second light source to emit a light beam of a second wavelength, modulated with information to be written to the information recording surface of the optical recording medium;

a light projecting means for condensing the second-wavelength light beam emitted from the first light source, projecting the condensed first-wavelength light beam as near-field light to the information recording surface of the optical recording medium when it is located in a field near the information recording surface, and projecting the second-wavelength light beam emitted from the second light source for focusing on the information recording surface;

a return-light amount detecting means for detecting a return-light amount of the near-field light projected to the information recording surface;

a reflected-light amount detecting means for detecting a reflected-light amount of the reflected part of the second-wavelength light beam focused on the information recording surface;

a first controlling means for controlling the light projecting means on the basis of the linear characteristic of the return-light amount of the near-field light detected by

the return-light amount detecting means to keep a predetermined distance within the near field from the information recording surface when writing information with the near-field light; and

a second controlling means for controlling the light projecting means on the basis of the linear characteristic of the reflected-light amount of the reflected light detected by the reflected-light amount detecting means to keep a predetermined distance beyond the near field from the information recording surface when writing information with the second-wavelength light beam.

25. The apparatus according to claim 24, further comprising a third controlling means for controlling, when the return-light amount detected by the return-light detecting means is larger than a predetermined threshold, the light projecting means to be within the near field from the information recording surface of the disk-shaped optical recording medium when writing information with the near-field light.

26. The apparatus according to claim 24, wherein the light projecting means includes an SIL (solid immersion lens).

27. The apparatus according to claim 24, wherein the light projecting means includes an SIM (solid immersion mirror).

28. The apparatus according to claim 24, further comprising a concave lens which directs the light beam of the second wavelength emitted from the second light source somewhat divergently toward the light projecting means,

the light projecting means condensing the light beam of the second wavelength

directed somewhat divergently by the concave lens for focusing on the information recording surface.

29. The apparatus according to claim 24, further comprising:

a two-group lens formed from a concave lens and collimator lens and which directs the light beam of the first wavelength emitted from the first light source or the light beam of the second wavelength emitted from the second light source toward the light projecting means; and

an inter-lens distance controlling means for controlling the distance between the concave lens and collimator lens included in the two-group lens,

the inter-lens distance controlling means controlling the inter-lens distance for the near-field light to be projected from the light projecting means when writing information with the near-field light, and for the light beam projected from the light projecting means to be focused on the information recording surface when writing information with the light beam of the second wavelength.

30. The apparatus according to claim 24, wherein the light projecting means includes an inter-lens distance controlling means including a two-group lens formed from an aspheric lens and SIL (solid immersion lens) and which controls the distance between the aspheric lens and SIL in the two-group lens,

the inter-lens distance controlling means controlling the inter-lens distance for the near-field light to be projected from the light projecting means when writing information with the near-field light, and for the light beam projected from the light

projecting means to be focused on the information recording surface when writing information with the light beam of the second wavelength.

31. The apparatus according to claim 30, wherein the two-group lens included in the light projecting means is formed from an aspheric lens and SIM (solid immersion mirror).

32. The apparatus according to claim 24, wherein:

the light projecting means is put into operation when the actuator is supplied with a predetermined control signal; and

the first controlling means including a deviation calculator to calculate a deviation from a control-target value for keeping the light projecting means at a predetermined distance in the near field from the information recording surface of the return-light amount of the near-field light detected by the return-light amount detecting means, and a control signal generator to generate a control signal used to control the light projecting means so that the deviation calculated by the deviation calculator is zero.

33. The apparatus according to claim 32, further comprising:

a filter connected in parallel to the control signal generator to remove a signal component of a frequency in a predetermined band from the deviation calculated by the deviation calculator; and

an adder to add together the control signal generated by the control signal generator and the deviation from which the signal component of the

predetermined-band frequency has been removed by the filter,

the result of addition in the adder being supplied as a control signal to the actuator to control the light projecting means.

34. An information recording controlling method comprising:

a first light projecting step in which there is condensed a light beam of a first wavelength modulated with information to be written to the information recording surface of an optical recording medium and emitted from a first light source and the condensed light beam of the first wavelength is projected as near-field light to the information recording surface from a light projecting means located in a field near the information recording surface of the disk-shaped optical recording medium;

a return-light amount detecting step in which there is detected a return-light amount of the near-field light projected to the information recording surface;

a first controlling step in which the light projecting means is controlled based on the linear characteristic of the return-light amount of the near-field light detected in the return-light amount detecting step to keep a predetermined distance within the near field from the information recording surface when writing information with the near-field light;

a second light projecting step in which a light beam of a second wavelength modulated with information to be written to the information recording surface of the optical recording medium and emitted from a second light source is projected by the light projecting means for focusing on the information recording surface;

a reflected-light amount detecting step in which there is detected a reflected-light amount of the reflected part of the second-wavelength light beam focused on the information recording surface; and

a second controlling step in which the light projecting means is controlled based on the linear characteristic of the reflected-light amount of the reflected light detected in the reflected-light amount detecting step to keep a predetermined distance beyond the near field from the information recording surface when writing information with the second-wavelength light beam.

35. An information reproducing apparatus comprising:

a first light source to emit a light beam of a first wavelength to read predetermined information recorded on the information recording surface of an optical recording medium;

a second light source to emit a light beam of a second wavelength to read predetermined information recorded on the information recording surface of the optical recording medium;

a light projecting means for condensing the second-wavelength light beam emitted from the first light source, projecting the condensed first-wavelength light beam as near-field light to the information recording surface of the optical recording medium when it is located in a field near the information recording surface, and projecting the second-wavelength light beam emitted from the second light source for focusing on the information recording surface;

a return-light amount detecting means for detecting a return-light amount of the near-field light projected to the information recording surface;

a reflected-light amount detecting means for detecting a reflected-light amount of the reflected part of the second-wavelength light beam focused on the information recording surface;

a first controlling means for controlling the light projecting means on the basis of the linear characteristic of the return-light amount of the near-field light detected by the return-light amount detecting means to keep a predetermined distance within the near field from the information recording surface when reading information with the near-field light; and

a second controlling means for controlling the light projecting means on the basis of the linear characteristic of the reflected-light amount of the reflected light detected by the reflected-light amount detecting means to keep a predetermined distance beyond the near field from the information recording surface when reading information with the second-wavelength light beam.

36. The apparatus according to claim 35, further comprising a signal extracting means for extracting a read signal and gap error signal by splitting the return-light amount detected by the return-light amount detecting means with a predetermined frequency,

the second controlling means controlling the near-field light projecting means on the basis of the linear characteristic of the gap error signal extracted by the signal

extracting means to keep a predetermined distance within the near field from the information recording surface.

37. The apparatus according to claim 35, further comprising:

a polarization splitting means for splitting, based on a difference in polarization plane, the return light of the near-field light projected to the information recording surface into a first return light and second return light,

the return-light amount detecting means detecting the amount of the second return light split by the polarization splitting means; and

the second controlling means controlling the near-field light projecting means on the basis of the linear characteristic of the amount of the second return light detected by the return-light amount detecting means to keep a predetermined distance within the near field from the information recording surface.

38. An information reproduction controlling method comprising:

a first light projecting step in which there is condensed a light beam of a first wavelength emitted from a first light source to read predetermined information recorded on the information recording surface of an optical recording medium and the condensed light beam of the first wavelength is projected as near-field light to the information recording surface from a light projecting means located in a field near the information recording surface of the disk-shaped optical recording medium;

a return-light amount detecting step in which there is detected a return-light amount of the near-field light projected to the information recording surface;

a first controlling step in which the light projecting means is controlled based on the linear characteristic of the return-light amount of the near-field light detected in the return-light amount detecting step to keep a predetermined distance within the near field from the information recording surface when reading information with the near-field light;

a second light projecting step in which a light beam of a second wavelength emitted from a second light source to read predetermined information recorded on the information recording surface of the optical recording medium is projected by the light projecting means for focusing on the information recording surface;

a reflected-light amount detecting step in which there is detected a reflected-light amount of the reflected part of the second-wavelength light beam focused on the information recording surface; and

a second controlling step in which the light projecting means is controlled based on the linear characteristic of the reflected-light amount of the reflected light detected in the reflected-light amount detecting step to keep a predetermined distance beyond the near field from the information recording surface when reading information with the second-wavelength light beam.

39. An information recording apparatus comprising:

a light source to emit a light beam of a predetermined wavelength modulated with information to be written to the information recording surface of an optical recording medium;

a light projecting means for condensing the predetermined-wavelength light beam emitted from the light source, projecting the condensed predetermined-wavelength light beam as near-field light to the information recording surface of the optical recording medium when it is located in a field near the information recording surface, and projecting the predetermined-wavelength light beam emitted from the light source for focusing on the information recording surface;

a return-light amount detecting means for detecting a return-light amount of the near-field light projected to the information recording surface;

a reflected-light amount detecting means for detecting a reflected-light amount of the reflected part of the predetermined-wavelength light beam focused on the information recording surface;

a first controlling means for controlling the light projecting means on the basis of the linear characteristic of the return-light amount of the near-field light detected by the return-light amount detecting means to keep a predetermined distance within the near field from the information recording surface when writing information with the near-field light; and

a second controlling means for controlling the light projecting means on the basis of the linear characteristic of the reflected-light amount of the reflected light detected by the reflected-light amount detecting means to keep a predetermined distance beyond the near field from the information recording surface when writing information with the predetermined-wavelength light beam.

40. An information recording controlling method comprising:

a first light projecting step in which there is condensed a light beam of a predetermined wavelength modulated with information to be written to the information recording surface of an optical recording medium and emitted from a light source and the condensed light beam of the predetermined wavelength is projected as near-field light to the information recording surface from a light projecting means located in a field near the information recording surface of the disk-shaped optical recording medium;

a return-light amount detecting step in which there is detected a return-light amount of the near-field light projected to the information recording surface;

a first controlling step in which the light projecting means is controlled based on the linear characteristic of the return-light amount of the near-field light detected in the return-light amount detecting step to keep a predetermined distance within the near field from the information recording surface when writing information with the near-field light;

a second light projecting step in which a light beam of a predetermined wavelength modulated with information to be written to the information recording surface of the optical recording medium and emitted from a light source is projected by the light projecting means for focusing on the information recording surface;

a reflected-light amount detecting step in which there is detected a reflected-light amount of the reflected part of the second-wavelength light beam focused on the

information recording surface; and

a second controlling step in which the light projecting means is controlled based on the linear characteristic of the reflected-light amount of the reflected light detected in the reflected-light amount detecting step to keep a predetermined distance beyond the near field from the information recording surface when writing information with the second-wavelength light beam.

41. An information reproducing apparatus comprising:

a light source to emit a light beam of a predetermined wavelength to read predetermined information recorded on the information recording surface of an optical recording medium;

a light projecting means for condensing the predetermined-wavelength light beam emitted from the light source, projecting the condensed predetermined-wavelength light beam as near-field light to the information recording surface of the optical recording medium when it is located in a field near the information recording surface, and projecting the predetermined-wavelength light beam emitted from the light source for focusing on the information recording surface;

a return-light amount detecting means for detecting a return-light amount of the near-field light projected to the information recording surface;

a reflected-light amount detecting means for detecting a reflected-light amount of the reflected part of the predetermined-wavelength light beam focused on the information recording surface;

a first controlling means for controlling the light projecting means on the basis of the linear characteristic of the return-light amount of the near-field light detected by the return-light amount detecting means to keep a predetermined distance within the near field from the information recording surface when reading information with the near-field light; and

a second controlling means for controlling the light projecting means on the basis of the linear characteristic of the reflected-light amount of the reflected light detected by the reflected-light amount detecting means to keep a predetermined distance beyond the near field from the information recording surface when reading information with the predetermined-wavelength light beam.

42. An information reproduction controlling method comprising:

a first light projecting step in which there is condensed a light beam of a predetermined wavelength emitted from a light source to read predetermined information recorded on the information recording surface of an optical recording medium and the condensed light beam of the predetermined wavelength is projected as near-field light to the information recording surface from a light projecting means located in a field near the information recording surface of the disk-shaped optical recording medium;

a return-light amount detecting step in which there is detected a return-light amount of the near-field light projected to the information recording surface;

a first controlling step in which the light projecting means is controlled based on

the linear characteristic of the return-light amount of the near-field light detected in the return-light amount detecting step to keep a predetermined distance within the near field from the information recording surface when reading information with the near-field light;

a second light projecting step in which a light beam of a predetermined wavelength emitted from a light source to read predetermined information recorded on the information recording surface of the optical recording medium is projected by the light projecting means for focusing on the information recording surface;

a reflected-light amount detecting step in which there is detected a reflected-light amount of the reflected part of the second-wavelength light beam focused on the information recording surface; and

a second controlling step in which the light projecting means is controlled based on the linear characteristic of the reflected-light amount of the reflected light detected in the reflected-light amount detecting step to keep a predetermined distance beyond the near field from the information recording surface when reading information with the second-wavelength light beam.